SCIENCE

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FRIDAY, JUNE 22, 1906.

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MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE FRANKLIN BI-CENTENARY.

THE celebration of the two-hundredth anniversary of the birth of Benjamin Franklin was held in Philadelphia in conjunction with the annual general meeting of the American Philosophical Society, on April 17 to 20, inclusive.

TUESDAY EVENING, APRIL 17.

The opening session was held in Witherspoon Hall at eight o'clock and consisted of an address by Vice-provost Smith, of the University of Pennsylvania, in his capacity as president of the society. In welcoming the delegates and visitors President Smith outlined the history of the society, dwelling on those who, like its founder, attained distinction in electricity.

The various delegates from learned societies and institutions of learning, to the number of about 180, were next received and many of them presented more or less formal addresses.

In the name of the University of St. Andrews, its lord rector, Mr. Andrew Carnegie, conferred the honorary degree of doctor of laws upon Miss Agnes Irwin, dean of Radcliff College.

WEDNESDAY, APRIL 18.

Meeting for the reading of papers on subjects of science, in the hall of the society, on Independence Square.

Morning Session—10 o'clock.

The Statistical Method in Chemical Geology: FRANK WIGGLESWORTH CLARKE, Sc.D., of Washington. (Illustrated by lantern slides.)

The statistical method in chemical geology was a development of his earlier work upon the relative abundance of the chemical elements. The average composition of the igneous rocks, as computed by Clarke and others, was compared with that of the sedimentaries. It was shown that in the decomposition of the igneous rocks, and the reconsolidation of the detrital products, the new rocks would consist of about five per cent. limestones, fifteen per cent. sandstones and eighty per cent. silicates, roughly classed together as shales. It was also shown that all of the sodium in the ocean and the sedimentaries would be furnished by the decomposition of a shell of igneous rock, completely enveloping the earth, less than one half mile thick. We thus have a statistical estimate of the total mass of the sedimentary rocks, and the proportions of their chief classes. Dr. Clarke also discussed, briefly, some of the uses which had been made of his former average for the igneous rocks, especially by Van Hise and by Joly. His criticisms were directed towards conservatism, and against drawing larger conclusions from the figures than their accuracy would warrant. The data need to be much more fully developed before any large use can be made of them.

On a Possible Reversal of the Deep-sea Circulation and its Effect on Geological Climates: Professor Thomas C. Chamberlin, of Chicago.

The preservation of a narrow range of temperature and a limited variation of atmospheric constituents throughout the millions of years of the biologic past was essential to organic evolution. Continued preservation for millions of years to come seems equally a condition precedent to an intellectual and spiritual evolution commensurate with the physical and biological evolutions that have preceded it. It has been customary to assign to the primitive earth a climate quite beyond the Miltonian conception of Gehenna in its fiery intensity and to forecast a final refrigeration scarcely inferior in its antithetic intensity. This is deduced from a gaseous nebula condensing through gravitation. Such a derivation has seemed to some of us inconsistent with the dynamics of the present solar system and an alternative view has been developed. This view involves a slow growth of the atmosphere to about its present volume, after which it was controlled by opposing agencies which maintained the narrow limits requisite. The agencies of *restraint* are molecular velocities, chemical combination and condensation. By virtue of the first, the lighter constituents are reduced to a minimum and all constituents are restricted within certain large limits. By virtue of the second, the chemically active factors are kept down to states of dilution compatible with organic evolution, while the inert elements have probably been permitted to increase steadily. By the third, the excess of water-vapor has been condensed into the ocean, which has probably increased rather than diminished through the ages. The postulated agencies of atmospheric *supply* are accessions from without and emanations from within, of which Vesuvius is just now giving us an impressive illustration.

Subsidiary to this control within narrow limits, pronounced variations must be recognized. In most geologic periods warm climates seem to have prevailed as high as 70° and 80° of latitude. How life of subtropical types could have survived the long polar nights is one of the most obdurate puzzles of the earth's climatology. But *between* the warm polar stages there were episodes of glaciation in strangely low latitudes. Extensive glaciation oc-

curred in India, Australia and South Africa in the later coal-forming stages of the Paleozoic era, the areas even lapping upon the Tropics of Cancer and Capricorn; yet figs and magnolias have grown in Greenland since. We are thus compelled to face oscillations ranging from subtropical congeniality within the polar circles to glaciation in low latitudes, and these in alternating succession, while none of the oscillation was permitted to swing across the narrow limital lines of organic endurance. There is little doubt that the ocean is one of the most potential agencies in controlling these oscillations and it is one of its climatic functions that invites our present attention. The carbonation of the ocean is subject to wide variations and the rapidity of this seems to be dependent chiefly on deep-sea circulation. In an endeavor to estimate the rate of this, it was found that the agencies that worked in opposite directions in promoting deep-sea circulation were very nearly balanced, whence sprang the suggestion that if their relative values were changed as much as geologic data imply, the direction of the deep-sea circulation might be changed, and that this might throw important light on some of the strange features of geologic climates.

The abysmal circulation is now dominated by polar agencies, as shown by the low temperature of the bottom waters even beneath the tropics. Cold waters creep slowly along the depths from the polar seas equatorward, where they gradually rise to the surface and return on more superficial routes.

The several influences of the winds, of atmospheric transfer of water, of differences in salinity and of differences of temperature, including freezing and thawing, were then discussed. Charts of the existing temperatures and salinities showed a close struggle between these opposing agencies. More saline but warmer waters both overlie and underlie less saline but colder waters. Computation of salinity-effects and temperature-effects also indicates a very close balance between the opposing agencies.

Now in the majority of geological periods the evidence of life indicates the absence of very low temperatures in the polar regions. Hence the inference that, at such periods, the balance would lie on the side of salinity and that therefore the deep oceanic circulation would be actuated by the dense waters of the evaporating tracts. These are supposed to have slowly descended and crept poleward, where they rose to the surface and gave their warmth to the atmosphere. Aided by the enshrouding mantle of vapors that must have arisen from such a body of water, it is conceived that the mild temperatures requisite for the maintenance of the recorded life through the polar nights may have been thus maintained.

Elementary Species in Agriculture: Professor HUGO DE VRIES, of Amsterdam, Holland.

An International Southern Observatory: Professor EDWARD C. PICKERING, of Cambridge, Mass.

A plan, possessing some novel features, for a telescope of the largest size was proposed, in which the best location, form of instrument, cost, administration and discussion of results were considered in turn. The best location in the world is desired, and is probably in South Africa, west of Bloemfontein, or in Peru. The relative advantages of reflectors and refractors were compared, with the conclusion that a reflector of seven-feet aperture and forty-five-feet focal length would be the best.

The great observatories of the world have each a plant costing two or three hundred thousand dollars, and an annual income of

about fifty thousand dollars. Capitalized, this would represent about a million and a half. For one third of this sum, or half a million dollars, the plan here proposed could be carried out with results which it is believed would advance astronomy in almost every department. The expense could be reduced by $100,000, or to $400,000, by giving the telescope to Harvard, which would then assume the cost of administration. The principal item, $250,000, would be required to provide a permanent annual income of $10,000. This would permit the telescope to be kept at work throughout every clear night, and in the proposed location almost every night would be clear. The remaining $150,000 would be spent on the telescope, and this estimate is based on the cost of the 24-inch reflector recently built for Harvard at an expenditure of $4,000. It was assumed that the expense of the drawings, plans and computations would increase as the first power, the hand and machine work as the square, and the material as the cube of the dimensions.

The special novelty of the plan was the method of discussing the results. While the principal work would be photographic, the use of the telescope visually, in various departments, was considered. The photographic results would be far greater than could be discussed by a single individual or institution. Therefore, it was proposed that an international committee should prepare a plan of work, and that copies of the photographs should be given to any one who could advantageously use them. Astronomers could doubtless be found in all parts of the world who would discuss these photographs, and could thus be furnished, without charge, with material of the highest grade, which could otherwise be obtained only at an expenditure of many thousands of dollars. So far as possible, they would be aided also by subsidies for paying salaries of assistants, for publication, etc. The donor would be guided in spending his money to the best advantage, not by a single astronomer, but by the astronomers of the world. His name, which would always be attached to the telescope and its work, would thus be known for all time, and throughout the world, rather than merely locally. It was urged that no better time could be found for inaugurating this scheme than when celebrating the memory of Benjamin Franklin, the greatest and most practical of American men of science.

The Figure and Stability of a Liquid Satellite (with lantern slides of diagrams): Sir George Darwin, K.C.B., F.R.S., of Cambridge, England.

Form Analysis: Professor Albert A. Michelson, of Chicago.

The analysis of forms of natural objects has been the subject of such careful and thorough treatment, that it would seem futile for one who can only claim to be an amateur in the science of morphology to attempt to add anything of real interest.

The work of Haeckel, to whom more than to any other, the greatest advance in the science is due, contains a very complete and detailed system of classification which applies to animate and inanimate forms; but with due deference to so great an authority, I would venture to propose some modifications in the nature of an extension of the accepted idea of *symmetry*.

The biologists generally restrict this idea to the forms ordinarily described as 'bilateral,' or 'dorsiventral' or to 'regular radial' forms. In a sense which among mathematicians is coming into use, the idea is extended to all forms in which congruence of parts is effected by any transformation which retains the essential character-

istics; but it would be a less radical departure if such transformations or 'operations' were limited to

A. Rotation (through 180°).
B. Reflection (in a plane).
C. Translation (in a straight line).

The corresponding subdivision of *symmetrical forms* would read:

A. Odd symmetrical.
B. Even symmetrical.
C. Rhythmic.
D. Partial. (Requiring at least two operations.)

Another modification which I should suggest is an extension of the idea of 'radial' symmetry to include forms which radiate from a point not in the center of the figure.

SYSTEMS OF SYMMETRY.

I. Radial Symmetry.
II. Axial Symmetry.
III. Plane Symmetry.

I. *Radial Symmetry.*

1. *Central.* (Radiant in center of figure.)
2. *Ovoid.* (Radiant in axis but not central.)
3. *Excentric.* (Radiant not in an axis.)

II. *Axial Symmetry.*

1. *Circular.* } (Corresponding points on the same
2. *Elliptic.* } perpendicular through axis.)
3. *Oval.* (Corresponding points not on the same perpendicular.)

III. *Plane Symmetry.*

1. Triplanar.
2. Biplanar.
3. Bilateral.

Unsymmetrical forms may be regular; and such may be represented by simple mathematical formulæ.

The study of form relations may appropriately include the graphs of analytical expressions, and the forms of physical phenomena—such as interference patterns; vortex forms of liquids, etc. These last often present close and suggestive analogies with biological forms.

The various kinds of symmetry and regularity were illustrated by lantern projections of forms selected from graphs of mathematical expressions, from physics, from crystallography and from botany and zoology. Most of these last were taken from Haeckel's beautiful 'Kunst-formen der Natur.'

Before reading his paper, Sir George Darwin presented to the society a medallion of Franklin made by Josiah Wedgewood, Sir George's grandfather.

Executive Session—12:30 P.M.

Stated Business—Candidates for membership were balloted for, and the following were elected as members of the society:

RESIDENTS OF THE UNITED STATES.

Hon. Joseph Hodges Choate, LL.D., D.C.L. (Oxon), New York.
Henry Herbert Donaldson, Ph.D., Philadelphia.
Russell Duane, Philadelphia.
David Linn Edsall, M.D., Philadelphia.
John W. Harshberger, Ph.D., Philadelphia.
Charles S. Hastings, Ph.D., New Haven, Conn.
William Francis Hillebrand, Ph.D. (Heidelberg), Washington.
Charles Rockwell Lanman, LL.D., Cambridge, Mass.
Franklin Paine Mall, M.D., LL.D., Baltimore.
Ernest Fox Nichols, D.Sc., New York City.
Hon. Elihu Root, LL.D., Washington.
Thomas Day Seymour, LL.D., New Haven, Conn.
Edward Bradford Titchener, M.A. (Oxford), Ph.D. (Leipsic), Ithaca, New York.
Otto Hilgard Tittmann, Washington.
Arthur Gordon Webster, Ph.D. (Berlin), Worcester, Mass.

FOREIGN RESIDENTS.

Adolf Engler, Ph.D., Berlin.
Dr. Hendrik Antoon Lorentz, Leyden, Holland.
Dmitri Ivanovitch Mendeleff, St. Petersburg.
Theodor Nöldeke, Ph.D., Strassburg.
August Weismann, Freiburg.

Afternoon Session—2 o'clock.

The Present Position of the Problem Concerning the First Principles of Scientific Theory: Professor JOSIAH ROYCE, of Cambridge, Mass.

The Human Harvest: President DAVID STARR JORDAN, of Stanford University, Cal.

On Positive and Negative Electrons: Professor H. A. Lorentz, of Amsterdam.

The Elimination of Velocity-Head in the Measurements of Pressures in a Fluid Stream: Professor Francis E. Nipher, of St. Louis.

Experiments made on a railway train with a Pitot tube show that when the wind blows across the mouth of the tube, the rarefaction produced is greater than the compression when the mouth is directed towards the wind. When the mouth is directed at an angle of 60° with the wind, there is neither compression nor rarefaction. When thus set, a Pitot tube will respond to the actual pressure in a pipe carrying a fluid stream. Velocity effects are eliminated. An improved form of the disk collector previously described by the author was also described and the two collectors shown were presented to the society. This collector also eliminates velocity effects.

Old Weather Records and Franklin as a Meteorologist: Professor Cleveland Abbe, of Washington.

This paper emphasizes the fact that some of our earliest weather records are due to the influence of Benjamin Franklin, and that he himself must be recognized as the first of American meteorologists. From boyhood he distrusted the supernatural and the superstitious explanations of natural phenomena. The animus of his whole life was a searching study of the motives of men and the forces of nature. His meteorological work began with a daily record and accompanying explanatory notes. He entertained every plausible hypothesis and tested it by experiment, logic and analogy. His study of the lightning and thunder-storm by experimental methods, and his study of northeast storms by the collection of reports from all parts of the country (equivalent to the modern graphic daily weather map) were but a fraction of his many studies of the atmosphere.

The paper collects together some published and unpublished items illustrative of the great variety of work that Franklin did bearing on meteorology, closing with his study of the cold winter of 1783–4 in Europe, and the prediction (which was perfectly well verified) of the cold winter of 1786–7 in Pennsylvania and New England. This last effort, based on sound physics and logic, entitles him to be recognized as the first long-range forecaster whose methods were in complete harmony with the present state of physical science.

Was Lewis Evans or Benjamin Franklin the First to recognize that our Northeast Storms come from the Southwest? Professor William Morris Davis, of Cambridge, Mass.

In 1747 Lewis Evans, of Philadelphia, prepared a description of the 'Middle British Colonies in America,' illustrated by a map, on which, among other explanatory legends, the following statement occurs: 'All our great storms begin to leeward; thus a NE storm shall be a day sooner in Virginia than in Boston.' This brief statement has been taken to be the earliest recognition, as it certainly is the first published statement, of the progressive movement of storms, on which the modern art of weather prediction so largely depends. A second edition of the essay and map was published in 1755; and as more topographical material had then been collected, the statement concerning storms above quoted was omitted. Evans's publishers were Franklin and Hare, and there is good reason for thinking that it was Franklin and not Evans who supplied the statement on the map about storms, along with some account of lightning and electricity; subjects which Evans does not treat elsewhere,

but which were just then much in Franklin's mind. A reference to the letters in Sparks's 'Life of Franklin' leaves no doubt on this point. It there appears that in 1747 Franklin wrote:

> We have frequently along the North American coast storms from the northeast, which blow violently sometimes three or four days. Of these I have had a very singular opinion for some years, *viz:* that, though the course of the wind is from northeast to southwest, yet the course of the storm is from southwest to northeast; the air is in violent motion in Virginia before it moves in Connecticut, and in Connecticut before it moves at Cape Sable.

It appears from the evidence of later letters that Franklin's first attention was called to this matter in connection with attempted observations on an eclipse of the moon which occurred in 1743, and which he failed to see because of the clouds of a northeast storm, yet which was seen by his brother in Boston, where the storm began somewhat later. From this simple hint Franklin followed up the matter with his customary acuteness, and established the point to his satisfaction. He seems to have added the statement to Evans's map with no claim whatever for recognition of his discovery; and to have allowed its erasure on the second edition of the map without remonstrance. Generous as he thus showed himself to the point of indifference, it is still fitting that we at this time should take pains to give credit where credit is due. Yet even if the source of the temporary item about storms is transferred to Franklin, the memory of Evans as a geographer need not suffer, for his descriptions of the 'Middle British Colonies' are really admirable, and show great power of observation and generalization.

Notes on the Production of Optical Planes of Large Dimensions: Dr. JOHN A. BRASHEAR, of Allegheny, Pa.

A New Mountain Observatory: Professor GEORGE E. HALE, Pasadena, Cal.

Evening Session—8 o'clock, at Witherspoon Hall.

Franklin's Researches in Electricity: Professor EDWARD L. NICHOLS, Ph.D., of Ithaca.

In the life of Franklin electricity was merely an episode. He was forty years of age at the time when the news of the discovery of the Leyden jar reached America and he appears to have taken up the subject as an amusement or hobby. That Franklin, whose investigations were all performed within a few years, should have become the foremost electrician of his time was extraordinary. The success of his 'Letters on Electricity,' which were translated into all the languages of Europe, was doubtless due in great part to the epigrammatic terseness, the clearness and simplicity of style, the naïve frankness and inimitable humor which characterize them.

Franklin's experimental achievements were confined chiefly to his observations on the powers of pointed conductors to discharge electrified bodies, his studies of the Leyden jar and his determinations of the character of the electrification of thunder clouds. In spite of his strongly utilitarian bent and his fondness for invention he was able to find in the field of electricity no application which could be of use to mankind. It is true that he invented the lightning rod, but this was a device for the protection of man from injury and not for the utilization of electricity.

That Benjamin Franklin should be the author of the one theory of electricity which, of all the views entertained on this subject by the men of his time, comes nearest to our twentieth century idea may seem strange, for electricity was with him merely a form of intellectual diversion into which he was drawn by accident in middle

life and which he soon abandoned for other and, as it seemed to him, more practical things. We need not, however, be astonished that he left his impress upon the science of his time. A man who in the middle of the eighteenth century rejected the doctrine of action at a distance and insisted upon the necessity of a universal medium pervading all space, and who, at the very zenith of Newton's fame, repudiated the corpuscular theory and thought of light as transmitted by a vibratory motion, must be recognized as possessing a native endowment unequaled by any of the intellects of his day.

The Modern Theories of Electricity and their Relation to the Franklinian Theory: Professor Ernest Rutherford, F.R.S., of Montreal.

Of the four days' celebration, one morning, that of Thursday, April 19, was given over to the University of Pennsylvania. It devoted that time to making the celebration memorable by the bestowing of honorary degrees upon distinguished men, Europeans as well as Americans. Dr. Hampton L. Carson, '71 C., '74 L., '06 LL.D., attorney-general of the commonwealth of Pennsylvania, made the oration of the day. After the academic procession had entered, the prayer was read by Rev. Dr. Alexander Mackay-Smith, Episcopal Bishop-Coadjutor of the Diocese of Pennsylvania. 'Alma Mater' was then sung, and the class of 1906 college presented a memorial tablet to Franklin, which will be placed on the walls of the Houston Club. It was presented through A. R. Ludlow, president of the class, and received by Vice-provost Edgar F. Smith, '99 Sc.D., '06 LL.D., in behalf of the university and the Houston Club. 'Ben Franklin' was sung, and then the honorary degrees were conferred. Provost Charles Custis Harrison, '62 C., made the presentation orations, and bestowed the degrees, Dr. Wharton Sinkler, '68 M., announcing the names of the recipients and escorting them, with Samuel F. Houston, '87 C., Joseph B. Townsend, Jr., '82 C., and George H. Frazier, '87 C., all of the board of trustees, as aides, to the provost. Vice-provost Smith was the first to receive his degree, doctor of laws. The provost's presentations of the degrees, with the degrees received, follow, in the order of presentation:

Edgar F. Smith—President of the American Philosophical Society. Worthy successor of Franklin, Rittenhouse, Jefferson, Bache. Eminent chemist; distinguished for his original work upon electrolysis. Vice-provost of the University of Pennsylvania. Humane. Beloved of God and men.—LL.D.

William Berryman Scott—Interpreter of world changes. Historian of the rocks and of past forms of life. Traveler over many lands, without the aid of the physicist; at times, however, using him, but not in accord with him. Lineal descendant of Franklin, and agreeing with him that sense is preferable to sound. Distinguished professor of geology and paleontology at Princeton University.—LL.D.

Edward Charles Pickering—Professor of astronomy and director of the Harvard College Observatory. 'It was on no earthly shore his soul beheld the vision,' but with reverent observation the stars in their courses have been, through him, a light to us from pole to pole. Student of the relation of stellar distance to the intensity of illumination. Distinguished founder of the first physical laboratory in America.—LL.D.

Hugo de Vries—King of the plant world. Foremost investigator. Research contributor to the knowledge of the physiology, heredity and cross-breeding of the vegetable kingdom. Distinguished also for his publications and reputation over two continents upon species variation. Professor of plant anatomy and physiology at the University of Amsterdam.—LL.D.

Albert A. Michelson—Head professor of physics in the University of Chicago. To be to-day considered the foremost physicist in the United States. Noted especially for his mathematical and experimental contributions upon the nature and properties of light.—LL.D.

Ernest Rutherford—McDonald professor of physics at McGill University, Montreal. First of

the physicists of Canada. Doubtless the leading authority in the world upon radioactivity, the latest and most important development in physical science.—LL.D.

EDWARD LEAMINGTON NICHOLS—Especially noted for his investigations on radiation and upon matter at low temperature. His researches have shed light upon the strange property of certain substances to become self-luminous by day or by night. Professor of physics at Cornell University.—LL.D.

WILLIAM KEITH BROOKS—Distinguished for his biological exploration of our Atlantic coast and of the West Indies; for the depth of his contributions to marine zoology; for his permanent studies in heredity and evolution and for his classical and philosophical essays thereon. Professor of zoology at the Johns Hopkins University.—LL.D.

WILLIAM PATERSON PATERSON—Professor of divinity in Edinburgh University and sometime professor of systematic theology at Aberdeen. Welcome to the privileges of a son of the University of Pennsylvania. From Aberdeen came Pennsylvania's first provost; from Edinburgh, our medical school—whose emblem has always been the thistle. Sincere teacher of the knowledge of things divine; comprehended briefly in that undying question: 'What does the Lord require but to do justly and to love mercy and to walk humbly.'—LL.D.

HENDRIK ANTOON LORENTZ—Facile princeps amongst the physicists of Holland, and peer of any of his scientific associates upon the continent of Europe. Noted especially for his work on mathematical physics and upon the 'electron theory.' Professor of mathematical physics in the University of Leiden.—LL.D.

ALOIS BRANDL—Professor of philology in the University of Berlin. Representative of the Batavian Society for experimental philosophy, a society of which Benjamin Franklin himself was a member. Shakespearean scholar. Student of 'the nature and history of man as disclosed by speech.' His personality as charming as his scholarship.—LL.D.

SIR GEORGE HOWARD DARWIN—Distinguished son of an illustrious father. Astronomer and mathematician. Plumian professor of astronomy and experimental philosophy at the University of Cambridge, England. Student of the effects of tidal friction upon the earth and moon. The name and fame of father and son will endure until 'Tideless sleep the seas of time!'—LL.D.

WILLIAM P. HENSZEY—Theoretical and practical engineer. Notable for his contributions to civilization, through his scientific work in the evolution of the modern American locomotive. Of great judgment and foresight in the solution of difficult mechanical problems. Through his efforts all the world becomes akin.—Sc.D.

JAMES GAYLEY—Noted for his contributions to the advancement of the science of analytical chemistry. Metallurgist. Combining in himself, in the highest degree, the rare qualities of scientific knowledge, and the power of transmuting this knowledge into practical results. Distinguished alumnus and trustee of Lafayette College.—LL.D.

HAMPTON L. CARSON—Able student. Master of legal, historical, constitutional and political science. Great power of orderly massing of facts. Attorney-General of the commonwealth of Pennsylvania. Loyal and devoted son of the University of Pennsylvania.—LL.D.

JOHN WILLIAM MALLET—Distinguished chemist of the University of Virginia, founded by Thomas Jefferson, one time president of the American Philosophical Society. Happy coincidence of the meeting of the chief chemist of the university founded by Jefferson and of the chief chemist of the university founded by Franklin—truly notable ancestors. His hitherto activity as chemist upon the scene of war has been devoted to the more faithful application of his great energy in the ways of peace.—LL.D.

In Absentia—GUGLIELMO MARCONI—Investigator, theoretical engineer, inventor. Born under the shadow of that ancient university, Bologna, in the land where dwells the Eternal City. Postmaster-general for thousands who 'go down upon the sea in ships,' and soon for the world.—LL.D.

SAMUEL DICKSON—Chancellor of the Law Association of Philadelphia. Learned in the law. Fit successor of Tilghman, Rawle, Ingersoll, Hopkinson and Sergeant—all college graduates, as he, of the University of Pennsylvania. Independent thinker.—LL.D.

ANDREW CARNEGIE—Lord Rector of the University of St. Andrews. Thou hast sought and thou hast found; thou hast knocked and it hath been opened unto thee; thou hast given of what thou hast received. World benefactor.—LL.D.

EDWARD VII.—King, Defender of the Faith, Emperor of India—Represented by the person of his Ambassador [Sir Henry Mortimer Durand, '05, LL.D.].—LL.D.

At the Court of St. James's, upon the twelfth day of August, 1763, His Majesty King George II. being present at the King's Most Excellent

Majesty in Council, it was ordered that the Right Honorable the Lord High Chancellor of Great Britain do cause Letters Patent to be prepared and passed under the Great Seal, authorizing the first provost, William Smith, to collect funds from all well-disposed persons for the assistance and benefit of the College, Academy and Charitable School in Philadelphia; and upon the ninth day of April, 1764, the Archbishop of Canterbury, together with Thomas and Richard Penn, addressed a joint letter to the trustees of the college, congratulating them upon the great success which had attended the efforts of the first provost, through His Majesty's Royal Brief.

The trustees of the University of Pennsylvania —the successors of the trustees of the same foundation—bearing in mind the interest which His Majesty, the then King of England, so graciously showed in the infant Institution in the Colony of Pennsylvania, now confer upon His Majesty, Edward VII., impersonating England, the highest degree in their power to bestow.

This royal throne of kings, this sceptred isle,
This earth of majesty, this seat of Mars;
This other Eden, demi-paradise;
This fortress, built by nature for herself,
Against infection, and the hand of war;
This happy breed of men, this little world;
This precious stone set in the silver sea,
Which serves it in the office of a wall,
Or, as a moat defensive to a house,
Against the envy of less happier lands;
This blessed plot, this earth, this realm, this England.

Then followed the address of Dr. Carson, which we have not space to print. It had to do not only with Franklin's achievements, but with that of all the noteworthy sons of Pennsylvania from his day to ours. 'Hail Pennsylvania' was sung, the benediction was pronounced, and Pennsylvania's official celebration of its founder was at an end.

In the absence of J. Hartley Merrick, '90 C., secretary of the board of trustees, Louis C. Madeira, '72 C., was master of ceremonies. Henry Budd, '68 C., was chief marshal, and the associate marshals were William H. Klapp, '76 M., '86 A.M.; Theodore M. Etting, '65 C., '79 L.; J. Willis Martin, '79 C.; H. S. Prentiss Nichols, '79 C.; H. Laussatt Geyelin, '77 C., '79 L.; Walter E. Rex, '75 L.; J. Wilks O'Neill, '77 C.; Ewing Jordan, '68 C., '71 M.; J. Somers Smith, Jr., '87 C.; Henry R. Wharton, '73 C., '76 M.; John H. Packard, '50 C., '53 M.; Frank M. Riter, '78 L.; William J. Taylor, '82 M.; John Douglass Brown, '79 C., '81 L.; Bernard Gilpin, '75 C., '78 L.; Charles Claxton, '79 C., '82 M.; William S. Wadsworth, '97 M.; Frank P. Prichard, '74 L.; Edward L. Duer, '60 M.; Charles F. Gummey, '84 C., '88 L.; William S. Ashbrook, '87 C.; and George M. Coates, '94 C., '97 M.

AT CHRIST CHURCH BURYING-GROUND, FIFTH AND ARCH STREETS, 4 P.M.

Ceremonies at the grave of Franklin under the auspices of the Grand Lodge of F. & A. M. of Pennsylvania. The delegates and members assembled in the hall of the society, on Independence Square, at 4 o'clock and proceeded to the grave of Franklin.

In honor of the occasion, the following organizations paraded to the grave:

The First Troop of the Philadelphia City Cavalry.
A battalion of United States Marines.
A battalion of United States Sailors.
The First Regiment of Infantry of the National Guard of Pennsylvania.
The Veteran Corps of the same regiment;
A provisional battalion of 800 United States Postmen.
The Veteran Firemen's Association.
A deputation from the Grand Lodge of Free and Accepted Masons of Pennsylvania.

The parade was under the charge of Col. Benjamin C. Tilghman, as grand marshal, and Major George E. Kemp, Major Charles T. Creswell and First Lieutenant Henry Norris as aides.

The parade formed on the west side of Broad Street, facing east, the right of the line being opposite the Masonic Temple,

and moved at 4 P.M. over the following route:

South on Broad to Market, passing to the east of the City Hall, east on Market to Twelfth, south on Twelfth to Chestnut, east on Chestnut to Fifth, north on Fifth to Arch, east on Arch to Fourth.

When the head of the column arrived at Fourth and Arch, the column halted and was formed to the right.

Wreaths were then placed on the grave of Franklin—

On behalf of the nation, by the President of the United States, through his specially appointed representative, Commander R. McN. Winslow, U.S.N.

On behalf of the state of Pennsylvania, by the governor of the state, through his specially appointed representative, Mr. Bromley Wharton, private secretary.

On behalf of the American Philosophical Society, by its president, Dr. Edgar F. Smith.

On behalf of the University of Pennsylvania, by Provost Charles C. Harrison.

On behalf of the Library Company of Philadelphia, by its presiding director, Mr. Edwin S. Buckley.

On behalf of the Pennsylvania Hospital, by its president, Mr. Benjamin H. Shoemaker.

On behalf of the Philadelphia Contributionship for the Insurance on Lives by Loss from Fire, by Mr. J. Rodman Paul, acting president.

On behalf of the Grand Lodge of Free and Accepted Masons of Pennsylvania, by the Right Worshipful Grand Master, George W. Kendrick, Jr.

On behalf of the Königliche Gesellschaft der Wissenschaften zu Göttingen, by its delegate, Dr. Emil Wiechert.

On behalf of the Königliche Preussische Akademie der Wissenschaften (Berlin), by its delegate, Dr. Alois Brandl.

On behalf of the Manchester Geographical Society, by its delegate, J. U. Brower.

A wreath was also deposited in the name of the Pennsylvania Society of the Daughters of the Revolution.

As the wreaths were placed upon the grave, a national salute was fired by the U. S. battle-ship *Pennsylvania*, anchored at the foot of Arch Street, and the troops in line presented arms, and the unarmed bodies in line uncovered.

Brief addresses were then made under the direction of the Grand Lodge of Pennsylvania, as follows:

Invocation, by Frank B. Lynch, D.D.
Franklin in Masonry, by George W. Kendrick, Jr.
Franklin as a Free Mason, by James W. Brown.
Franklin as a Diplomatist, by John L. Kinsey.
Franklin as a Scientist, by Peter Boyd.
Benediction, by Robert Hunter, D.D.

At the conclusion of the ceremonies, the parade again formed in column and the march was resumed south on Fourth Street to Walnut, and then west on Walnut to Broad Street, where the parade was dismissed.

At nine in the evening a general reception was given by the society to its friends and to the visiting delegates, at the Bellevue-Stratford.

FRIDAY, APRIL 20, AT THE AMERICAN ACADEMY OF MUSIC, 11 A.M.

The delegates, invited guests and members met in the foyer of the academy at 10:45 A.M. and proceeded in a body to occupy the seats assigned them.

Addresses in Commemoration of Benjamin Franklin:

'As Citizen and Philanthropist,' by Horace Howard Furness, Litt.D. (Cantab.).

'As Printer and Philosopher,' by President Charles William Eliot, LL.D.

'As Statesman and Diplomatist,' by the Hon. Joseph Hodges Choate, LL.D., D.C.L.

Presentation of the Franklin Medal to the Republic of France (in accordance with the Act of Congress), by the Honorable Elihu Root, Secretary of State (by direction of the President).

Reception of the Medal, by His Excellency, M. J. J. Jusserand, the French ambassador.

IN THE HALL OF THE SOCIETY ON INDEPENDENCE SQUARE.

Meeting for the Reading of Papers on Subjects of Science, 3 P.M.

Repetition and Variation in Poetic Structure: Professor FRANCIS BARTON GUMMERE, of Haverford, Pa.

The primitive form of poetry everywhere is verbal repetition in exact rhythm. The complicated forms of verse spring from this exact repetition by means of variation, which in some cases, notably the Anglo-Saxon, achieves a permanent and dominant principle. Curious survivals occur even in Shakspere. Other forms of poetry, however, move towards the freedom of prose.

The Herodotean Prototype of Esther and Sheherazade: Professor Paul Haupt, of Baltimore, Md.

In the ninth edition of the 'Encyclopædia Britannica,' Vol. XXIII., pp. 316–318, De Gœje showed that Sheherazade was identical with Esther. There is, however, one difference: Sheherazade is determined to save the daughters of her people at the risk of her life; her father tries in vain to dissuade her. Esther, on the other hand, hesitates; but her foster-father urges her to risk her life to save her people. The exchange of messages (Est. IV., 5–17) between Esther and her foster-father, which led to the execution of Haman, bears a striking resemblance to the exchange of messages between Phædymia and her father Otanes, as related by Herodotus (III., 68), which led to the assassination of Pseudo-Smerdis.

Just as the stories in the 'Arabian Nights' are accommodated to a framework, so Herodotus's history of Xerxes's invasion of Greece is but the framework for a vast mass of legendary, antiquarian and ethnological lore. The stories in the 'Arabian Nights' may be classified in three categories: fables, fairy-tales and anecdotes. The fables are ultimately Babylonian; the fairy-tales, Persian; and the anecdotes, Arabic. Some of the tales are evidently transformed myths.

The story of the antagonism between Haman and Vashti, on the one hand, and Mordecai and Esther, on the other, may ultimately be a nature-myth reflecting the victory of the deities of spring over the frost-giants of winter.

Heredity and Variation, Logical and Biological: Professor Wm. Keith Brooks, of Baltimore.

Notes on a Collection of Fossil Mammals from Natal: Professor William B. Scott, of Princeton.

The director of the Natal Geological Survey, William Anderson, Esq., has sent me for examination and report a series of mammalian bones, which were collected by him on the coast of Zululand, South Africa. Concerning the mode of occurrence of these fossils, Mr. Anderson writes me as follows:

> The fossils were scattered over a large outcrop of shales, which occurs below the level of ordinary low-water marks, and is only exposed under the exceptional circumstances of a strong southeasterly gale and a neaptide, when the large covering of sand is removed. Overlying this bed are a series of shales with a few scattered bones, and crustacean and fish remains. Above these a thin layer containing foraminifera and then a foot or so containing marine mollusca, which Mr. Etheridge referred to the Tertiary period; above this a thick series (probably over 100 feet) of false-bedded sands of various colors covered by the recent sand dunes.

So far, I have been able to make only a cursory examination of these fossils, which were much injured by their long journey and are still in the preparator's hands. They are heavy, dark in color and more or less completely mineralized. In character, the mammals are specifically South African and appear to represent a late Pliocene fauna. The species seem to be all different from those now living, though referable to recent genera. The list includes an elephant nearly allied to the modern species, a hippopotamus of very large size, a buffalo (*Bubalus*) and two or three antelopes. In addition to these mammals, the collection contains several fish and a very large crocodilian vertebra.

Interesting as these fossils are from many points of view, they are disappointing in that they throw little light upon the problems of faunal origins and migrations in the southern hemisphere.

The Use of Dilute Solutions of Sulphuric Acid as a Fungicide: Professor HENRY KRAEMER, of Philadelphia.

It is stated by Bloxam that finely divided sulphur is gradually oxidized and converted into sulphuric acid when exposed to moist air. It is well known that sublimed sulphur contains a certain amount of sulphuric acid. Not only is this true, but it is claimed that if the sublimed sulphur be not dried after washing it to free it of acid, sulphuric acid is again formed. Furthermore, it has been pointed out by Polacci that sulphur when mixed with the soil is changed directly into sulphuric acid.

As a fungicide and insecticide, sulphur is applied directly in the powdered form, or it is applied in the form of a paste to the heating pipes in greenhouses, or it is gently heated on a sand bath, when it is sublimed and distributed over the plants in a finely divided state.

The fact that sulphur is used in the several ways indicated led to the question as to whether sulphuric acid is not produced under these conditions and as to whether it is not the active agent, destroying the fungus but not injuring the host.

Experiments were first carried on to determine what compounds are formed when sulphur is slowly heated. An apparatus was constructed for heating the sulphur and collecting the gases formed, and it was found that when sulphur is slowly vaporized with access of air that as much as fifteen per cent. of the vaporized sulphur may be converted immediately into sulphuric acid, little or no sulphurous acid resulting.

It being thus pretty well established that sulphuric acid is formed under the conditions in which sulphur is used in greenhouses, another series of experiments was carried on to determine the strength of solution which would not be toxic to the host plant. It was found that practically under all conditions, including variation in temperature and susceptibility of different plants to the action of the acid, a solution containing approximately one part of sulphuric acid to 1,000 parts of water could be used as a spray without any injury to the plants. The solution is best applied late in the afternoon after first sprinkling the plants with water.

The efficiency of dilute sulphuric acid as a fungicide has been shown by applying it to roses which were badly affected with mildew. Plants growing outdoors as well as in the greenhouse have been treated successfully. The roses were uninjured by the acid solution and they immediately began to develop new leaves and young shoots entirely free from mildew after three to six applications on alternate days. The acid solution seems to exert a beneficial action on the plants apart from the fungicidal action.

Should subsequent experiments confirm these observations, the use of sulphuric acid will have certain advantages over the use of sulphur, as it does not discolor the foliage as sulphur does, its employment is more easily controlled, and it does not have the odor of the other compounds associated with sulphur.

Franklin and the Germans: Professor M. D. LEARNED, of Philadelphia.

While Franklin's importance as a cultural mediator between the German and English colonists in America has never been clearly recognized by the English, the Germans have given the highest praise to his services and perpetuated his name, rather than that of their most cherished

German names, in the first German college of the colonial time, Franklin Academy, founded at Lancaster in 1787.

Franklin had a large share in the printing of German works for the Germans in the Colonies, having been second only to Bradford and a close competitor of Christoph Saur. So German did his firm, Benjamin Franklin and Johann Böhn, become that his name was written Fränklin in the German fashion. Franklin's attitude toward the Colonial Germans finds various expression in his works. The earliest of these utterances is found in his *Plain Truth* (1747), where he calls them the 'brave and steady Germans.' In 1751 he comes out strongly against the upper Germans, calling them 'the Palatine Boors' and classifying them among the 'tawny' races. Again in 1753 he deplores their disrespect for their ministers and teachers and their unwillingness to become 'anglified,' or to adopt the English language, and their indifference in siding with the English colonists against the French, although he commends them for their industry and frugality. Franklin's relations with the continental Germans are illustrated by the honors he received at the University of Göttingen (1766) by the clever Jeu d'esprit of 1777, the 'Dialogue between Britain, France, Spain, Holland, Saxony and America,' and the letter 'From the Count de Schaumbergh to Baron Hohendorf,' etc., the latter being an interesting companion piece to Schiller's 'Kabale und Liebe.'

Another interesting illustration of Franklin's influence in Germany is found in a batch of some eighty unpublished German letters directed to him by Germans of all sorts advocating schemes and soliciting information and aid. These letters are soon to be published by the writer of this paper. The first tribute to Franklin, perhaps in any language, is that given by Herder, the great friend of Goethe at Weimar, in his 'Letters for the Furtherance of Humanity': 'The mind devoted to the true and useful, the teacher of mankind, the director of a great society of men.'

The Use of High-explosive Projectiles: Professor Charles E. Munroe, of Washington.

In 1885, the author discussed in Van Nostrand's *Engineering Magazine* various experiments made in testing the use of high explosives in projectiles, and in conclusion stated the conditions essential for efficiency. He has now reviewed the experiences of the intervening years and finds his conclusions of 1885 fully confirmed.

Ammoniacal Gas Liquors: Professor Charles E. Munroe, of Washington.

In preparing a report on the gas industry of the United States for the census of 1905 it was found that manufacturers gave the strength of the ammoniacal liquors in a great variety of units, such as degrees Twaddell, per cents. of NH^3 or ammonium sulphate and 'ounce strength,' the latter being the favorite. In an investigation looking toward finding a means of reducing these to a common basis it was found that 'ounce strength' as used in the United States has a different meaning from what it has abroad, for in adopting this method of measurement here it has been applied to the United States gallon instead of the Imperial gallon, for which it was devised. This tends to explain the apparent difference in the yields from coals in the United States as compared with European coals.

Chromosomes in the Spermatogenesis of the Hemiptera Heteroptera: Professor Thos. H. Montgomery, Jr., of Austin, Texas.

The spermatogenesis of forty species of this group was described in detail, with especial regard to the history of the

chromosomes. Chromosomes are classified into the following kinds: *autosomes,* the unmodified chromosomes, and *allosomes,* the modified chromosomes. Of the latter, two kinds may be distinguished in the Hemiptera: *diplosomes,* those that occur in pairs in the spermatogonia, and *monosomes,* those that occur single there. The diplosomes may conjugate in the synapsis stage and divide in the first maturation mitosis reductionally, in the second equationally, as previously described by the writer ; or they may divide in the reverse order with a conjugation in the second spermatocytes, as described by Wilson. Both kinds may occur in the same cell. The monosomes usually divide equationally in the first maturation division and do not divide in the second; more rarely they divide in the reverse order; in one species the monosome does not divide in either of these mitoses. The same species may have two kinds of monosomes as well as diplosomes. In 1901 the writer proved that the chromosomes occur in pairs in the spermatogonia, that of each pair one element is of paternal and one of maternal origin, and that in the synapsis stage is accomplished a conjugation of maternal with paternal elements. Here a still greater series of evidence is brought in support of this contention, showing that for almost all the species examined the determination of the pairs in the spermatogonia is facile; and further, evidence is now brought that the two chromosomes of a pair are not exactly similar in volume, but apparently constantly slightly different in this respect, sometimes also in form, so that it is possible to distinguish which is the paternal and which the maternal element. The sum total of the chromosomes of a cell, that is, of the chromatin and linin, must be regarded as forming a single nuclear element, of which the chromosomes, though they undoubtedly preserve their individuality, are only subdivisions; a particular chromosome represents a particular set of hereditable energies, the sum total of them all the energies of one individual, that is to say, the sum total of them when in the reduced number. This state of division of labor may be termed chromosome differentiation. In the Hemiptera there is given the possibility of following the behavior of any single chromosome through a great series of cell generations, as well as of deciding whether it be paternal or maternal, which brings us nearer the analysis of the hereditable substance than has been possible heretofore.

A banquet at the Bellevue-Stratford on Friday evening was the closing feature of a most memorable occasion.

SCIENTIFIC JOURNALS AND ARTICLES.

DR. E. W. TAYLOR contributes to the June issue of the *Journal of Nervous and Mental Disease* an article on the clinical course and pathological anatomy of multiple sclerosis, illustrated by twelve complete case reports and a number of cuts showing the microscopical findings. He reaches the following conclusions: (1) The rarity of the disease in this country has been over-estimated. A more careful examination of atypical cases and a more open mind in diagnosis is desirable. (2) The importance of observing and properly estimating minor symptoms of the disease, particularly unexplained spasticity and ocular disorders, must be emphasized. (3) The etiology remains obscure. The pathological anatomy is still a hopeful field for study. Present evidence points towards a primary destruction of the myeline with either a secondary or coincident proliferation of the neuroglia. An exhaustive bibliography of the subject for the years since 1903 is appended. Dr. G. A. Moleen reports an interesting case of subcortical cerebral gumma, accurately localized in the comatose state, and Dr. Alfred Gordon follows with a brief contribution to the study of the 'paradoxic reflex.'

SOCIETIES AND ACADEMIES.

THE NORTH CAROLINA ACADEMY OF SCIENCE.

THE fifth annual meeting of the North Carolina Academy of Science was held at West Raleigh, May 18 and 19. The following officers were elected for the ensuing year:

President—Dr. Collier Cobb, of the State University at Chapel Hill.

Vice-President—Professor J. L. Lake, of Wake Forest College.

Secretary-Treasurer—Dr. F. L. Stevens, A. and M. College, West Raleigh, N. C.

Members of the Executive Committee—Mr. Franklin Sherman, Jr.; Dr. W. C. Coker, of Chapel Hill, and Professor John F. Lanneau, of Wake Forest College.

The following papers were presented:

Autophytographs: COLLIER COBB.

Name suggested by C. H. White (*Am. Jour. Sci.*, March, 1905) for a plant record formed by the extraction of coloring matter through decay of plant, or a black deposit reproducing perfectly the leaves of plants, illustrated by specimens from the neighborhood of Wilkesboro, N. C., and elsewhere. Such records should also have been made in geological past, and Dr. Cobb reported fern autophytographs on Carboniferous rocks from near Pottsville, Pa., exhibiting two different specimens of the same.

Notes on the Variation in the Number of Eggs or Young produced by some American Snakes: C. S. BRIMLEY.

This paper gave the largest, smallest and average number of eggs or young produced, according to the author's experience, by the following species of North American snakes—*Eutænia sirtalis, Eutænia saurita, Natrix sipedon, Haldea striatula, Storeria dekayi, Storeria occipitomaculata, Virginia valeriæ, Bascanium constrictor, Heterodon platyrhinus, Ophibolus getulus, Cyclophis æstivus, Coluber quadrivittatus, Carphophiops amœnus, Ancistrodon contortrix, Ancistrodon piscivorus.* Comments are also made on the confusion caused by the application locally of the same popular or local name to different species of snakes in different places, and by different names being applied to the same species.

Dr. W. C. Coker explained with blackboard drawings the development and the nuclear changes within the embryo sac of the ordinary poplar tree, *Liriodendron.* The special point of interest was that though this tree is very ancient geologically, yet its embryo sac presents no unusual features.

Sugaring for Moths: C. S. BRIMLEY.

The author's experience in sugaring for moths in July, August and September, 1905, were given. Names the mixtures employed and how applied, and what species of moths and other insects were captured. Notes that a very large proportion of the attracted moths were species of economic importance, *viz.*, the army-worm and cutworm moths, which do considerable injury to field and garden crops. Notes what insects were attracted to the sugared patches in the daytime and also that rough-barked trees were better to sugar than smooth-barked ones.

Rhætic Flora of Moncure Shales: COLLIER COBB.

Specimen of *Liriodendron*(?) reported from Deep River Trias in 1904 in association with *Macrotæniopteris,* and then regarded by speaker as Lower Trias, led to the tracing of this bed eight miles northeastward through Lockville to Moncure, and to the discovery of one nearly complete *Liriodendron* leaf and several fragments in association with lycopods, conifers and equisetaceæ, with many examples of more modern plants yet to be determined, constituting what is probably a transition flora. Many of the specimens were from a well recently dug by the Seaboard Air Line Railway.

The Influence of Citrous Stocks on Scions: Mr. C. F. REIMER.

An investigation was made in Florida to determine whether the stock influences the scion in any way. The following outline covers most of the work which was done:

1. Influence on rate of growth—(*a*) in diameter, (*b*) in height.

2. On shape of tree.

3. On hardiness.

4. On diseases.

5. On fruit—(*a*) amount, (*b*) quality, (*c*) season of ripening, (*d*) color, (*e*) dropping.

Interesting results were obtained which will appear in SCIENCE in full at a later date.

Mr. J. C. Temple discussed the bacterial flora of cow manure, showing the average number of germs present in fresh manure and in manure of different ages. The relation of these various germs to the nitrogenous material of the manure. He also presented important results concerning the distribution, abundance and variation of the colon bacillus.

A paper by Lewis T. Winston in his absence was presented by Dr. F. L. Stevens on 'Bacterial Analysis of the Various Lithia Waters,' in which it was stated that while most of the lithia waters are above reproach from a bacterial view point, some of them are of such condition that if submitted to the ordinary board of health analysis they would be condemned.

Dr. C. W. Coker discussed 'Types of Liverworts Especially Useful in Elementary Classes in Botany.'

Mr. W. C. Etheridge explained a series of tests which he had made concerning the various methods of analysis of milk, to determine the effects of various media, various ages of plate, different degrees of acidity, and effect of ventilation upon the bacterial count.

Mr. C. S. Brimley presented a paper on the 'Zoology of Lake Ellis, Craven County, N. C.'

Mr. W. C. Coker gave the results of his investigation upon the cytology of the endosperm of the Pontederiaceæ.

Food Adulteration: Mr. W. M. ALLEN.

This paper showed the great effect of the adulteration of human foods on mankind; how it effects both the health and the wealth.

It seems that the greatest danger to health lies in the use of chemical preservatives in fresh meats and sausages by butchers and meat men, often ignorant, having no conception of what they are dispensing to their customers.

The meeting was well attended and an interest was manifest. It is probable that the next meeting will be held at Chapel Hill one year from the present date.

F. L. STEVENS,
Secretary.

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

THE society has had a very successful year under the presidency of Dr. George M. Kober, whose address, 'The Health of the City of Washington,' was a striking exposition of the value of practical anthropology in vital questions.

The following is a list of papers read:

'The Mound Builders of Eastern Mexico,' Dr. J. Walter Fewkes; 'The Work of Blind Indians,' Dr. A. Hrdlicka; 'Coins and Coinage,' Colonel Paul Beckwith; 'The Development of the Talking Machine and its Utilization in Anthropology,' George C. Maynard; 'Mechanical Aids to the Study and Recording of Language,' Dr. P. E. Goddard; 'The Naming of Specimens in American Archeology,' C. Peabody and K. Moorehead; 'Diseases of the Indians, more especially of the Southwest United States and Northern Mexico,' Dr. A. Hrdlicka; 'The Introduction of Reindeer among the Natives of Alaska,' Dr. Sheldon Jackson; 'Archeological Explorations on the San Francisco River, Arizona and New Mexico,' by the general secretary; 'Helen Keller, her Life, Associates and Achievements,' John Hitz; 'A Native Moxa (Cautery) among the Klamath Indians,' F. V. Coville; 'Anatomical Vestiges in Human Organisms,' Dr. D. S. Lamb; 'The Babylonian Code of Laws or Hammurabi and the Laws of Moses,' I. M. Casanowicz; 'Existing Shadows of Primitive Conditions,' C. H. Robinson; 'Recent Archeological Investigations on the Pajarito Plateau,' Professor E. L. Hewett; 'The Family in Social Organization,' J. N. B. Hewitt; 'Critical Remarks on Social Organization,' Dr. John R. Swanton; 'The Remains of Prehistoric Man in North Dakota,' Professor Henry Montgomery; 'The People of the Philippines,' Dr. Albert E. Jenks; 'The Igorote of Luzon,' W. E. Safford; 'The History of Anthropology in the District of Columbia,' Professor O. T. Mason; 'The Interrelations of the Sciences,' Dr. Max West;

Fragments of Californian Ethnology: 'A Mortuary Ceremony and other Matters,' Dr. C. Hart Merriam; 'Human Illusions,' A. R. Spofford. At the closing meeting for the year, obituary notices of deceased members were read as follows:

Dr. Washington Matthews, by James Mooney.

Dr. Swan M. Burnett, by Dr. D. S. Lamb.

Col. Weston Flint, by J. D. McGuire.

Mrs. Hannah L. Bartlett, by Mrs. Marianna P. Seaman.

Mr. S. H. Kauffmann, by Professor W. H. Holmes.

Mr. W. H. Pulsifer, by the general secretary.

The society proceeded to the election of officers, with the following results:

President—Mr. J. D. McGuire.

Vice-presidents—(a, somatology), Dr. A. Hrdlicka; (b, psychology), Dr. J. Walter Fewkes; (c, esthetology), Professor W. H. Holmes; (d, technology), Dr. Walter Hough; (e, sociology), Mr. James Mooney; (f, philology), Mr. J. N. B. Hewett; (g, sophiology), Miss Alice C. Fletcher.

General Secretary—Dr. Walter Hough.

Secretary to the Board of Managers—Dr. John R. Swanton.

Treasurer—Mr. George C. Maynard.

Curator—Mrs. Marianna P. Seaman.

Councilors—F. W. Hodge, J. R. Swanton, J. W. Fewkes, I. M. Casanowicz, Paul Beckwith, J. B. Nichols, J. N. B. Hewett, James Mooney, W. E. Safford and Mrs. Sarah S. James.

Walter Hough,
General Secretary.

THE AMERICAN CHEMICAL SOCIETY. NEW YORK SECTION.

The eighth regular meeting of the New York Section was held Friday evening, May 11, at the Chemists' Club, Dr. F. D. Dodge presiding. The following papers were read:

The Insoluble Chromi-Cyanides: F. V. D. Cruser and E. H. Miller.

The paper reviews the work done many years ago on the chromi-cyanides, gives an improved method for the preparation of potassium chromi-cyanide and describes the properties and analysis of this salt. The only insoluble chromi-cyanides are those of silver, cadmium, mercurous mercury, nickel, cobalt, cupric and cuprous copper, zinc, manganese and ferrous iron. These precipitates were found to have the normal composition whether Cr(CN)6 or cathion was in excess.

The Dissociation of Water Vapor and Carbon Dioxide at High Temperatures: Irving Langmuir.

It is shown that, when carbon dioxide or steam is passed slowly over glowing platinum wires, these gases are dissociated to an extent corresponding to the true chemical equilibrium at the temperature of the wire. The degree of dissociation was determined with considerable accuracy for temperatures ranging from 1,000° to 1,300°, and was found to agree closely with the van't Hoff formula. The temperature was determined from the change of electric resistance of the glowing wire, the temperature coefficient having been determined in an electric furnace.

The Condensation of 4-Nitro Acetanthranil with Diamines: W. Klaber and M. T. Bogert.

4-nitro acetanthranil can be prepared rapidly and readily, in any desired amount, from o-toluidine. It was condensed with hydrazine hydrate, ethylene diamine hydrate, and with guanidine. With hydrazine, both amino quinazoline and diquinazolyl were obtained. With ethylene diamine and guanidine, various quinazolines and intermediate amides were isolated.

The Synthesis of 6-Nitro-2-Methyl-4-Ketodihydroquinazolines from 5-Nitro Acetanthranil: E. P. Cook and M. T. Bogert.

The authors prepared 5-nitro acetanthranil from 5-nitro acetanthranilic acid, and, by condensing this anthranil with various amines, obtained the 6-nitro-2-methyl-4-ketodihydroquinazoline, together with its 3-methyl, 3-ethyl, 3-phenyl and 3-amino derivatives, as well as the diquinazolyl corresponding to the latter. Both the amino quinazoline and the diquinazolyl carry acetic acid of crystallization.

On the Alkyl Oxygen Ethers of Alpha Oxyquinazolines and the Isomeric 3-(N)-Alkyl Derivatives of the Corresponding Alpha Quinazolons: H. A. Seil and M. T. Bogert.

On treating various alpha oxyquinazolines

with alkali and methyl iodide, the N-methyl derivative resulted in every case. With ethyl iodide, both O- and N-derivatives were obtained, while with the higher iodides the O-compound was the chief product. The pure N-alkyl compounds were prepared from the acyl anthranils, and the pure O-compounds from the corresponding chlorine derivatives and sodium alcholates. A large number of isomers were prepared and examined, both of nitrated and unnitrated quinazolines.

F. H. POUGH,
Secretary.

THE TORREY BOTANICAL CLUB.

THE meeting of May 8, 1906, was held at the American Museum of Natural History at 8 P.M., with President Rusby in the chair.

The scientific program was an illustrated lecture by Dr. Grace E. Cooley on 'Forestry.'

The lecture considered the relation of forests and forest products to man, and the consequent importance of an intelligent comprehension of the principles and economic bearings of forestry. The nature of various important species of trees was treated of from the standpoint of silviculture, treating the tree as an individual plant; forestry, considering tree groups, or forests; physiography, discussing the relation of trees to the landscape and physiographic processes, and also from the point of view of economics and esthetics. The historical development of the U. S. Bureau of Forestry was briefly traced from the early beginning when a few interested persons met regularly at the home of Mr. Gifford Pinchot for discussion and instruction until the present organization of the national forest service. Forestry in other countries was also alluded to, and its long recognition and advanced stage of perfection abroad, standing in contrast to its rather tardy development in the United States.

C. STUART GAGER,
Secretary.

THE CALIFORNIA BRANCH OF THE AMERICAN FOLK-LORE SOCIETY.

THE eighth meeting of the California Branch of the American Folk-Lore Society was held at Cloyne Court, Berkeley, Tuesday, April 17, 1906, at 8 P.M. Mr. Charles Keeler presided. The minutes of the last meeting were read and approved. Dr. J. W. Hudson, having been approved by the council, was elected to membership in the society. On motion, Charles Keeler, A. H. Allen and P. E. Goddard, previously appointed by the Berkeley Folk-Lore Club as a committee to report on the feasibility of making a special study of the folk-lore of Berkeley and vicinity, were elected to represent the California Branch and to secure the cooperation of the two societies in the undertaking. A report reviewing the work of the society during the first year of its activity, which closed with this meeting, was read by the secretary. Dr. H. du R. Phelan, captain U. S. Volunteers, gave the address of the evening on 'The Peoples of the Philippine Islands,' based on a sojourn of several years in different parts of the archipelago and illustrated with numerous ethnological specimens. At its conclusion Dr. Phelan's talk was discussed by the members. The acting president thereupon announced the conclusion of the first year of the society's existence and the meeting was adjourned. Forty-five persons attended the meeting.

A. L. KROEBER,
Secretary.

DISCUSSION AND CORRESPONDENCE.

FACTS AND THEORIES IN EVOLUTION.

WITH reference to the writings of Weismann, I wrote in 1896,[1] that he has constantly mixed up the origin of species and variations, and the origin of adaptive characters. This holds good also at the present time, and may be said of other writers. The confusion is partly due to Darwin's phrase: origin of species, which was intended to include the whole process of evolution; but we must bear in mind that the latter is composed of several distinct processes.

In a recent article in SCIENCE,[2] Dr. F. Wayland Vaughan gives a review of de Vries's

[1] *Pr. Am. Philos. Soc.*, 35, 1896, p. 191.
[2] SCIENCE, May 4, 1906, p. 681.

mutation theory, and although, in general, his remarks and criticism appear to me well supported, he does not emphasize enough the fact that de Vries has entirely wrong ideas with regard to the process of species-making (*speciation*), and that he confounds it with *variation*. Indeed, Vaughan points out (p. 684) that de Vries's conception of species (elementary species) is inadequate; but he fails to see that this is a vital part of the mutation theory, and that the latter stands and falls with it.

In addition, I should like to express here a few opinions, which differ slightly from those set forth by Vaughan, and which I shall try to substantiate in the following paragraphs. The *first* is, that I think the theories of Darwin and of Weismann to be fundamentally different, Weismann always having incorrectly understood Darwin's view; thus it is impossible to regard the theory of Weismann as a kind of an amendment to that of Darwin, and to oppose both to the Lamarckian view; the *second* is, that I believe that the inheritance of acquired characters is an assumption that is 'entitled to respect and consideration' (Dall) not only because it is apt to explain certain facts, but chiefly so because it is the only theory that is based upon sound philosophical principles, the alternative theory being logically deficient. Besides, there is a *third* point, to which I object, namely, that Vaughan claims that 'the great value of de Vries's work consists in having shown that the origin of species is an object of experimental investigation.' I do not need to discuss this here again, since I have shown lately[3] that de Vries's experiments have no relation at all to the making of species (speciation), but only to the question of variation, and that they belong to a class of experiments that was known long ago.

I. The Darwinian theory has always been misinterpreted by Weismann in so far as he claimed that the emphasis laid by him upon natural selection, the 'all-sufficiency' of the latter, is the original Darwinian idea. But a perusal of Darwin's writings shows that, although he emphasizes natural selection as a *new* principle discovered by himself, he does not mean to say that it is the *only* factor in evolution.[4] This is seen at once by the fact that three chapters (1, 2, and 5) of the 'Origin of Species' are devoted to another factor, variation, while the struggle for life and natural selection are treated in the chapters 3 and 4; and on p. 100 ('Origin of Species'), at the end of the fourth chapter, Darwin condenses his ideas upon half a page in a summary, mentioning *three* factors: *variation; struggle for life* (resulting in *natural selection*); and *inheritance.*

I have shown previously[5] that Darwin also perceived that another question was to be settled, that of the differentiation into species (*speciation*); but with regard to this his ideas were somewhat hazy ('Origin of Species,' chapters 12 and 13). In my opinion, this point in Darwin's theory is the one that needed further elucidation, and this lack has been supplemented by M. Wagner by his separation theory.

That Darwin has been correctly understood by others in so far as it was seen that evolution is influenced by different, independent factors, is clearly shown by the exposition of his views as given, for instance, by Haeckel. I remember well, almost a quarter of a century ago, when I attended Haeckel's lectures on general zoology, that he made it a special point to bring home the idea that evolution as a general process in nature is not a *theory*, but a *logical deduction* from three well-established *facts.* The same view is found in Haeckel's 'Natuerliche Schoepfungsgeschichte' (3d ed., 1872), where he mentions (p. 139) *inheritance* (Erblichkeit) and *variation* (Veraenderlichkeit)[6] as the fundamental properties of the organisms, to which should be added Darwin's principle of the *struggle for life* (p. 144).

The same *three* factors in evolution are mentioned by Davenport (quoted by Vaughan, *l. c.*, p. 690) as: *variation, inheritance* and

[3] Science, May 11, 1906, p. 746.

[4] See Ortmann in *Pr. Am. Philos. Soc.*, 35, 1896, p. 187, 190.

[5] *Ibid.*, p. 182.

[6] Haeckel uses variation and adaptation as synonyms (see *l. c.*, p. 197), which should be borne in mind.

adjustment, and it is probably better to use the latter word (or *adaptation*), if we want to emphasize that these factors are *empirical facts;* adjustment is a fact directly observed in nature, while the struggle for life is an inference drawn from other observations.

I am prepared to accept this view in its full meaning, namely, that we have to deal here with *facts, which may be observed in nature,* and the *logical consequence* of the operation of these facts is *evolution,* that is to say, the change of the organic world, or its transmutation. But this does not exhaust all the existing phenomena, for we observe in nature a *fourth fact,* namely, that the chain of organisms is cut up in species. This we may call, with O. F. Cook, *speciation,* and thus we obtain altogether *four facts: variation, inheritance, adjustment, speciation.* These four facts would satisfactorily explain the whole of the organic world, if the *causes* of each of them were known: the process of evolution, consequently, is undeniable, and our investigations should be conducted so as *to discover the causes of each of the main factors in evolution.* As we shall see presently, the discussion in evolution, and the differences of opinion have hinged chiefly upon this question of the causes of these facts, and while in two of them the causes are very clear, in the other two they are much disputed.

It is the chief shortcoming of some of the modern writers, for instance Weismann and de Vries, that they are oblivious of this fundamental idea of evolution, and the consequence has been an utter confusion in their views. For me it is simply past comprehension, how it was possible that the writings of Weismann and de Vries have come to be looked upon favorably, and to be regarded as worthy of serious consideration.

I have always regarded *segregation* (*isolation, separation*), as introduced by M. Wagner, as the *cause of speciation.* This is, in my opinion, the most vital improvement upon Darwin's theory, and it is not opposed to it, but rather an amendment or addition to it. In this line, I have done some work myself, chiefly by trying to show the real extent of the term segregation (Gulick). I shall not go into detail here,[7] and only want to point out that I consider speciation as fully explained by biological segregation. The latter is a *fact* which, although it has not been demonstrated in all cases, is now supported by a sufficient number of actual observations, and what is most important, a case that is opposed to it has never been found, namely, that two closely allied species occupy absolutely the same range under identical ecological conditions. Many other writers concur with me on this point, and I name, aside from M. Wagner, J. T. Gulick, G. Baur, D. S. Jordan, J. A. Allen, C. H. Merriam.

As the *causes of adjustment,* we are to regard the *struggle for existence* and *natural selection* consequent to it. Vaughan (*l. c.,* p. 690) objects to the use of 'natural selection,' and possibly rightly so, considering how this term has been abused, preeminently on the part of Weismann. But the real value, and the correct conception of natural selection has been indicated by G. Pfeffer in a paper[8] which generally seems to have escaped attention. If we use natural selection in Pfeffer's sense (not as the survival of the fittest, but as the survival of fit individuals), I do not see why this term should be objected to or discarded. The struggle for life, which causes natural selection, and consequently adaptation or adjustment, is a logical deduction from observations in nature, for we always see that more individuals are produced than finally can find place in the economy of nature. This has been amply demonstrated by Darwin and others, and thus the causes of adjustment are

[7] See my publications: Grundzüge der marinen Tiergeographie, Jena, 1896, p. 33. On Separation, and its bearing on Geology and Zoogeography (*Amer. Journ. Sci.,* 2, 1896, p. 63). On Natural Selection and Separation (*Pr. Amer. Philos. Soc.,* 35, 1896, p. 182). Isolation as one of the factors in Evolution (SCIENCE, January 12, 1906). A Case of Isolation without Barriers (SCIENCE, March 30, 1906).

[8] 'Die Umwandlung der Arten, ein Vorgang functioneller Selbstgestaltung' (*Verhandl. Naturwiss. Ver. Hamburg* (3), 1, 1894).

to be considered as well known, being represented by indisputable *facts*.

Inheritance is a *fact* which can not be denied, but the *causes* of inheritance are unknown. However, we possess *theories* with regard to it, one of which is Weismann's germ-plasm theory. I am not going to discuss this here. The latest investigations on the minute processes in fertilization, as well as experiments on heredity, go far to advance our knowledge as to the causes of inheritance, but at present it is impossible to say to what end they finally may lead.

Variation is antagonistic to inheritance, and is also a *fact*. For a long time its *cause* seemed to be plain, and Darwin held the opinion that it is due to *changes of environment*, and he believed at the same time that changes thus produced might become hereditary ('Origin of Species,' in the very beginning of chapter 1, p. 5; further on, p. 8, and then again in chapter 5, p. 103). In this respect Darwin was entirely upon the standpoint of Lamarck, who was the first to express the idea of evolution in consequence of inheritance of acquired characters, chiefly by use and nonuse (here we have the recognition of *two* principles: inheritance and variation). Later, a different opinion began to prevail, namely, that acquired characters, such as are due to external stimuli, are not transmitted, and that only *variations of another class, which have a different cause*, are inherited. These are the so-called 'spontaneous,' 'germinal' or 'congenital' variations. This view was chiefly defended by Weismann, although he was not the first to propose it. Finally, de Vries maintains that it is *mutation*, and not variation that is inherited,[9] or more correctly that it is only a *certain form of variation* that is transmissible (connected with the species-making process), namely, that which is represented by sudden leaps.

Thus we see that the main dispute was with reference to the *causes of variation*, and we can distinguish *three* chief theories, which do not entirely correspond to the scheme given by Vaughan.

1. Dynamic theory (Dall). Evolution is started by variation due to external stimuli; these variations are transmissible to the offspring.

In this general view, we have to distinguish a development in four steps, each representing an improvement upon the older ideas, but not being contrary to them.

(*a*) Lamarckian view: two factors are recognized—variation and inheritance. Variations are called adaptations.

(*b*) Darwinian view: three factors are recognized—variation, inheritance and natural selection (struggle for life). Variations are not always adaptations, but may be disadvantageous. The struggle for life disposes of them. A fourth factor (speciation) is also indicated by Darwin, but not clearly recognized.

(*c*) Wagnerian view: addition of the fourth factor segregation (separation) as producing speciation.

(*d*) Pfeffer's correction of Darwin's conception of natural selection.

2. The view that not all variations are caused by external stimuli, and that not all variations are transmissible, but only those that are due to 'inner' causes. This view was held formerly by Weismann, but is now abandoned by him practically, although not professedly. This view is at present often called the Darwinian hypothesis, but wrongly so.

3. The view of de Vries. He also contends that only a certain class of variations is transmissible, that is to say, may start the formation of new species. This class is what he calls mutations. As to the causes of mutation de Vries is noncommittal.

I, for my part, accept the dynamic theory with all its amendments. I decline to consider the two other views, the third for reasons set forth recently.[10] I have also given my reasons for rejecting Weismann's views,[11] but it might be well to condense here again, why I believe that the theory of the transmission of acquired characters possesses a better title

[9] This is all that remains of de Vries's views after they have been stripped of their most obvious fallacies.

[10] Science, May 11, 1906.

[11] *Biolog. Centralblatt*, 18, 1898, p. 139 ff.

to respect and consideration than that of Weismann.

II. Vaughan claims that there is no experimental evidence for the transmission of acquired characters. This is not so, there *is* evidence. For instance, the experiments of Weismann with *Polyommatus phlæas,* quoted by Vaughan, *are* evidence, when properly interpreted.

With reference to the latter, I have said:[12]

> What the Lamarck-Darwinian theory maintains is that external stimuli acting upon an individual may produce changes in its characters, and that these changes are transmissible, *i. e.*, may reappear in subsequent generations. But this is now exactly the view of Weismann. To quote his example, in the butterfly *Polyommatus phlaeas,* increased temperature (external stimulus) effects darker color (change of character), and Weismann further believes that this character (dark color) may reappear in subsequent generations in consequence of the increase of temperature.

For the *hereditary transmission* of such acquired characters Weismann has his own theory, *but this theory does not deal any more with origin of transmissible variations, but is a theory of inheritance* (*l. c.,* p. 155).

I think this settles the point: we see that characters reappear in the offspring that have been acquired by the parents. Observations to this effect are known, and, furthermore, I believe that *all* variations are due to external stimuli, and that *there are no variations due to so-called inner causes alone.* For there is a grave logical error in the latter assumption (*l. c.,* p. 144). The conception of spontaneous variation implies that a certain class of causes does not act in variation, namely, the causæ efficientes. Now, every process in nature must have three kinds of causes: causæ materiales, causæ efficientes, and causæ finales. The exclusion of the second class, while only the first and third are admitted, renders this assumption illogical: we need a causa efficiens, or external stimulus. That is to say, no germinal or spontaneous variation is thinkable, unless there is an external stimulus. Each and every variation must be consequent on an external stimulus, which necessarily precedes it in time.

[12] *Biolog. Centralblatt,* 18, 1898, p. 153.

An objection often made in cases where the transmission of acquired characters seems probable is that the acquired character again disappears in subsequent generations, after the external influence has ceased, that is to say, that the variations revert to the original form. Of course, this should happen. As I understand the dynamic theory, its claim is that external influences permanently change organisms only when they remain permanent in their action, and that it takes time, and, if the expression is permitted, effort on the part of the environment to render any change more or less stable. But just this latter effect is due to inheritance, and repeated inheritance only is able to fix a character to such a degree, that it in turn obtains the necessary inertia to be classed with the stable, that is to say, inherited, characters, which offer a certain resistance to additional changes of environment. In this respect, J. A. Allen's remarks are pertinent,[13] where he emphasizes the *simultaneous and permanent action of external conditions upon large numbers of individuals.* A change in the external conditions must act upon a multitude of animals, and they all must vary, and if they are more or less uniform in organization, they must vary in the same or a similar direction. This is the real starting point for any transformation that is to become permanent. I do not believe that in nature single chance variations (due to unusual stimuli acting but once) ever become the parents of a similarly changed offspring, but I think it is always a large number of specimens, in fact practically all that live under the changed environment that begin to vary: the environment simply forces them to do so. This fact, and we have evidence for it (see Allen, *l. c.*), goes far to furnish direct proof for the action of external stimuli in variation, and the phrase 'pressure of environment' introduced by C. H. Merriam[14] for this fact, the permanent and irresistible application of certain external forces upon a multitude of organisms, expresses this identical view. This pressure, generally, does not stop again after

[13] SCIENCE, November 24, 1905, p. 667.

[14] SCIENCE, February 16, 1906, p. 244.

it has once begun, and thus a permanent change is brought about. If we consider this, then the objection that sometimes the changes of the organisms have disappeared after the normal conditions had been reestablished, does not hold good; in fact, this was to be expected (compare Naegeli's experiments with *Hieracium;* also de Vries's experiments furnish examples).

This way of looking upon the 'pressure of environment,' as producing a certain tendency to vary in a definite direction, easily explains it that we *have* evidence of definite variation. M. M. Metcalf[15] is inclined to believe that such instances are in favor of the assumption of the action of inner causes; but I do not see why this should be so. A repeated or constant action of the same external stimulus should produce in any organic form the tendency to react upon this stimulus in a definite way. This has been called *orthogenesis* by Eimer. Such cases are known, and I do not hesitate to attribute them to a permanent action of the same external force upon a multitude of individuals. Of course, as soon as this process is well started, inheritance begins also to play a part, and it is this latter factor that finally firmly establishes the new characters.

As to the value of experiments in the study of variation, I want to call attention to the difficulty in interpreting the facts, when such experiments are made under artificial and unnatural conditions, as, for instance, in the botanical garden, or with domesticated forms. Here it is apparent that such a complexity prevails, not only a few, but a large number of conditions being different from those in nature, that the experiment becomes a bewildering maze. In my opinion, experiments should be made in close touch with nature, changing, if possible, only one or a few of the conditions, so that we may be able to record the effects of each single changed factor in the environment. But I do not believe that this is an easy task. On the other hand, we should bear in mind that nature has made and is making these experiments for us: the process of variation is going on continuously, and the effects of former variation are seen in nature, and may be studied in the shape of the actually existing variations, varieties and species, and their relation to the environment (ecology). This work naturally falls within the scope of the systematist, and is largely field work; specimens of this kind of work have been furnished by Merriam, Allen and others, and the modern ecological researches are just what is wanted. But we must confess that so far we have only the beginning of this study, which should be encouraged and enlarged. For *ecology* teaches us what the different types of environment are, and how the different elements in the environment affect each other, and how changes of environment may effect changes in the organization of the different forms of life dependent on it.

A. E. Ortmann.
Carnegie Museum, Pittsburg, Pa.,
May 28, 1906.

[15] Science, May 18, 1906, p. 787.

SPECIAL ARTICLES.

CORPUSCULAR RADIATION FROM COSMICAL SOURCES.

In my address[1] before the Physical Society, I gave an account of observations made several times daily since May 9, 1905, in a search for the possible occurrence of an ultramundane radiation. The work was there summarized as follows:

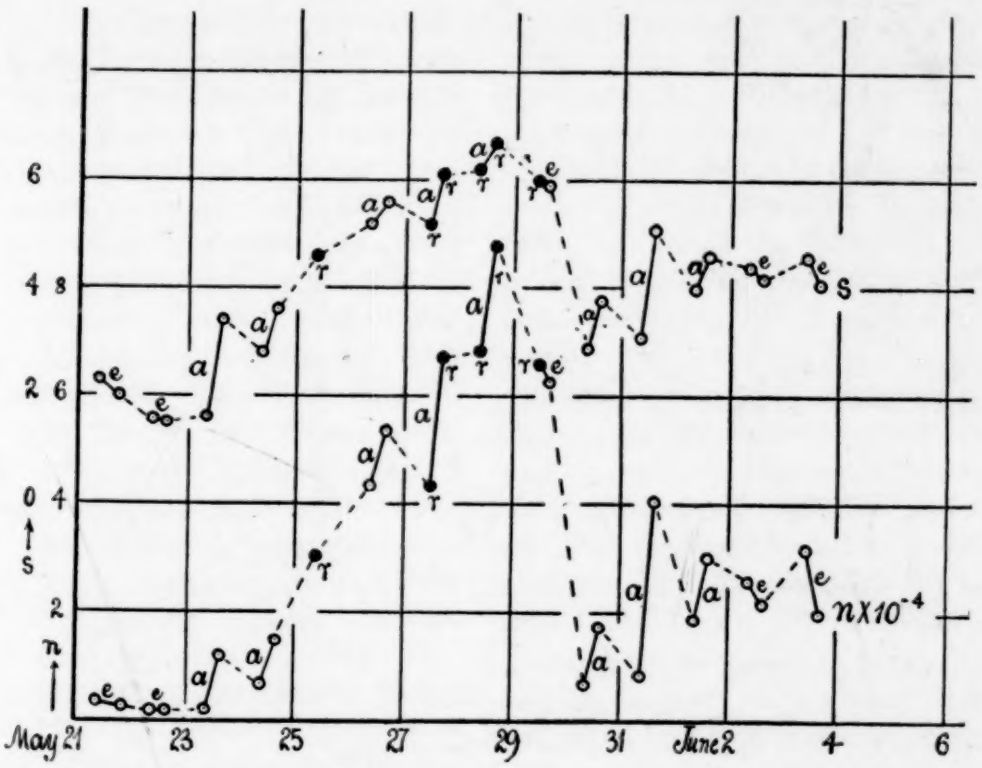
> Using the most sensitive condensation method, *i. e.*, that depending on the depression of the limiting asymptote of non-energized, dust-free air, no change of the quality of scrupulously filtered atmospheric air has thus far been detected. * * * Naturally (ions) would vanish during the slow passage of air through the filter, but fresh ions should be reproduced within the fog chamber by the same agency which generates them without * * *. Probably, therefore, the coronal method is as yet inadequately sensitive to cope with the variations of the small nucleations specified.

The ions, which are relatively large nuclei, withdraw much of the available moisture which would otherwise be precipitated on the colloidal nuclei of dust-free air. Hence the size of the terminal corona is diminished.

[1] *Physical Review*, XXII., p. 105, 1905; also p. 109 on 'radiant fields.'

The advantage of the method is its independence of the drop in pressure if this exceeds a certain value.

Since the announcement by A. Wood and A. R. Campbell[2] of the probability of cosmical radiation as evidenced by the existence of a daily period of the same, showing maximum ionization between 8 and 10 A.M. and 10 P.M. and 1 A.M., minimum ionization at about 2 P.M. and 4 A.M., I have taken the subject up again. It seems possible that I overestimated the sensitiveness of the earlier method. I have, therefore, changed it in the present experiment, replacing the large terminal coronas by the small coronas very near the fog limit. The observations, in other words, are now made with a drop in pressure but just sufficient to produce coronal condensation on the larger colloidal nuclei of dust-free air ($\delta p = 21$ cm.). The sizes of coronas vary rapidly with the pressure difference and hence with the barometer, etc., and great care must be taken with these details. This, however, has been done and the results obtained are given in the following figure. The ordinates show the angular diameter, s, of the successive coronas, from which the number of efficient nuclei, n, per cubic centimeter may be obtained. Observations were made at about 9 A.M. and 3 P.M. (as near the time of the Wood and Campbell maxima and minima as my duties permitted) on the successive days and hours given by the abscissas.



Upper curve: Relative values of the angular diameters of coronas for the same drop of pressure, on the days and hours given by the abscissas. The branches *a* are in agreement with the Wood-Campbell discovery; the branches *e* show a tendency to inversion; *r* denotes rain. *Lower curve:* nucleations in ten thousands of colloidal nuclei per cubic centimeter of dust-free air computed from the preceding curve.

The figure shows, in the first place, that minima and maxima of nucleation would generally have to appear at about the time at which Wood and Campbell observed maxima and minima of ionization, respectively; or that an inversion of Wood and Campbell's results is in question, since there is usually incremented nucleation in the afternoon as compared with the morning. This, however, may

[2] *Nature*, 1906, Vol. 73, p. 583. Reference is also due to the work of Burton and McLennan.

be explained, if the ions are large even in comparison with the larger gradations of colloidal nuclei. Fewer of these will, therefore, be captured in proportion as the ionization is larger. Hence the figure shows at *a* a corroboration of Wood and Campbell's results; at *e* an omission or inversion of the periods. But the *e*'s are much fewer in number, and in comparison with the amplitude of the *a*'s the *e*'s are frequently neutral.

In the second place the high nucleations during the period of rain are noteworthy. Here then few ions were present. As there is a modification of the atmospheric potential gradient during this time, one would favor an explanation on similar lines to the ideas suggested by Richardson.[3] From the above I could merely infer, however, that a region of rain is opaque to the cosmical radiation, though the periods are not wiped out. Moreover, the interpretation here is not straightforward and much must be left for future determination.

Since last August (1905) a systematic comparison between the dust contents and the ionization of the atmosphere has been carried out in this laboratory by Miss L. B. Joslin. As the paper is soon to appear in the *Physical Review*, I will merely state that no relation between the two curves of monthly ionization and the nucleation curve is discernible. Ionization and dust contents of the atmosphere are, therefore, not only to be referred to totally different sources, but are independent of each other. The origin of the former is, therefore, essentially non-local. Again the positive and negative monthly ionizations show curiously opposed periods in the successive months (August to March) which may be of relevant interest.

I may add in conclusion that if the final isothermal drop of pressure in the fog chamber, instead of being observed as was my custom heretofore, is computed from the volumes of the fog and vacuum chamber and the corresponding pressures, the data for the colloidal nucleation of dust-free air found in my large coronal chambers agree with the data which I endeavored to deduce from the disc colors seen by Wilson in his small and unique apparatus. In other words, the condensational efficiency which I have reached in spite of size is now surpassed by no other form.

[3] *Nature*, LXXIII., p. 607, 1906.

Carl Barus.

Brown University,
Providence, R. I.

RECENT MUSEUM PUBLICATIONS.

Report of the American Museum of Natural History for 1905.—It is difficult in reviewing the work of so large an institution, whose growth extends along many different lines, to select the more salient features of the year, but the completion of the work of preparing and mounting the skeleton of the great dinosaur *Brontosaurus* may be regarded as the feature of 1905. This one piece is probably responsible for a goodly portion of the 565,489 visitors, but the fine bird groups, one of flamingoes and one of the bird life of the San Joaquin Valley have attracted many.

As usual, many important fossil vertebrates have been secured during the year, including portions of the great carnivorous reptile *Tyrannosaurus*.

Special attention has been given to the public schools by preparing loan collections and by lectures; no less than 600 bird skins and 1,800 insects were purchased for the preparation of loan collections and 400 cabinets are now available for circulation.

In concluding his report President Jesup notes that this marks his twenty-fifth year of service and calls attention to the progress of the museum made possible by the support of the citizens of New York.

The Fourth Annual Report of the Horniman Museum notes a falling off in the number of visitors, primarily due to discouraging irresponsible and frivolous visitors from using the museum as a promenade. A noteworthy feature of the museum is the very considerable number of living animals, vertebrates and invertebrates, shown during the year, although this must necessitate much work on the part of attendants. On the other hand, living animals are very popular and instructive. The various little handbooks issued are very good

and sold at the practically nominal price of one penny each.

The Hull (England) *Museum Publications* 30 and 31 are mainly devoted to a description of recently acquired whaling relics and contain much information as to whaling between 1598 and 1868. The whaling fleet of Hull at one time numbered 60 vessels, averaging perhaps 325 tons each; the average number of whales taken in 1821 was 14 to a ship, which gives a good idea of the former abundance of the right whale. It is interesting to speculate on the effect produced on the balance of life by the wiping out of these great animals, and the consequent sparing of billions of the minute invertebrates on which they fed.

Notes on Some Recent Additions to the Exhibition Series of Vertebrate Fossils in the U. S. National Museum figures and briefly describes several important specimens, including crania of *Triceratops calicornis* and *Diceratops hatcheri,* both types. The suggestion, made by Professor Lull, that the lateral vacuities in the frill of this last species, were the result of injuries does not seem tenable. The skeleton of the female mastodon from Michigan is most admirably mounted and the measurements given show the animal to have been about two feet lower than the adult male.

The Preservation of Antiquities, by Dr. Friedrich Rathgen, issued by the Cambridge University Press, while not a museum publication, is of very general interest. The chapters of special value relate to the development, so to speak, and subsequent preservation, of objects of bronze and iron, and the figures show some very striking results that have been obtained by the processes described. It is to be noted that, as in other branches of museum work, care, and above all, patience are necessary adjuncts. *Zapon,* so often alluded to, is the subject of an article in the *Scientific American* for June 2.

F. A. L.

THE PRESERVATION OF AMERICAN ANTIQUITIES.

WE print below the bill passed by congress and signed by the President in the preservation of American antiquities. Regulations, in accordance with the provision of Section 4, are now being formulated.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any person who shall appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity situated on lands owned or controlled by the Government of the United States, without the permission of the Secretary of the Department of Government having jurisdiction over the lands on which said antiquities are situated shall, upon conviction, be fined in a sum not more than five hundred dollars or be imprisoned for a period of not more than ninety days, or shall suffer both fine and imprisonment in the discretion of the court.

Sec. 2. That the President of the United States is hereby authorized, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and may reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected: *Provided,* That when such objects are situated upon a tract covered by a bona fide unperfected claim or held in private ownership, the tract, or so much thereof as may be necessary for the proper care and management of the object, may be relinquished to the Government, and the Secretary of the Interior is hereby authorized to accept the relinquishment of such tracts in behalf of the Government of the United States.

Sec. 3. That permits for the examination of ruins, the excavation of archeological sites, and the gathering of objects of antiquity upon the lands under their respective jurisdictions, may be granted by the Secretaries of the Interior, Agriculture, and War, to institutions which they may deem properly qualified to conduct such examination, excavation, or gathering, subject to such rules and regulations as they may prescribe: *Provided,* That the examinations, excavations, and gatherings are undertaken for the benefit of reputable museums, universities, colleges, or other recognized scientific or educational institutions, with a view to increasing the knowledge of such objects, and that the gatherings shall be made for permanent preservation in public museums.

Sec. 4. That the Secretaries of the Departments aforesaid shall make and publish from time to time uniform rules and regulations for the purpose of carrying out the provisions of this Act.

THE REPORT OF COMMITTEE ON THE WALTER REED MONUMENT.[1]

The committee on the Walter Reed memorial fund desire to submit, as is required, their report, and, as their work is practically finished, would ask to be discharged.

The amount subscribed to the fund up to May 1, 1906, as reported to the committee by General Calvin DeWitt, secretary of the Walter Reed Memorial Association, is $20,943.64. The amount paid in is $19,730.64, leaving subscribed, but not yet paid, $1,213.

It was the desire of the committee and also of the Walter Reed Memorial Association that the sum of $25,000 should be raised. The committee regret very much indeed that American cities and towns which have been devastated by yellow fever have contributed much less than $1,000 all told, and nothing in the way of public, municipal or state subscriptions. They still further, and especially regret that the sum total from Cuba has been only $25. It seems to the committee that the country from which yellow fever was eradicated after having been continually present for 140 years, and which has had pointed out to it clearly the way in which future epidemics can be absolutely avoided, should certainly have made some substantial acknowledgment of the services of a surgeon who not only made a contribution of enormous value from the sanitary point of view, but who has established its future commercial prosperity.

The committee can not tell precisely the amount subscribed by the medical profession, but it is a very large proportion of the nearly $20,000 collected to date. It gives us pleasure to call attention to the fact that while few business men have recognized the enormous money value of Dr. Reed's services, to say nothing of the saving of human lives, his own profession has given such substantial recognition of the worth of his services in preventing a disease which has committed such dreadful havoc in the past, but will never do so again.

Joseph D. Bryant,
A. C. Cabot,
T. S. Cullen,
Victor C. Vaughan,
Robert F. Weir,
W. W. Keen, *Chairman.*

[1] Presented at the Boston meeting of the American Medical Association.

THE SHALER MEMORIAL FUND.

The following circular has been sent by a committee of alumni of Harvard University to the graduates of the College and the Scientific School:

Nathaniel Southgate Shaler, S.D., LL.D., professor of geology and dean of the Lawrence Scientific School, died in Cambridge, April 10, 1906, after more than forty years of faithful work at Harvard.

Professor Shaler's remarkable personality made a profound impression on the college and the community. The names of over 6,000 students have been enrolled in his classes. In recognition of his great services to the university, the executive committee of the Alumni Association has appointed the committee named below to secure a Shaler memorial fund, the form of the memorial and the disposition of the principal and income of the fund to be determined by the committee.

It is believed that many Harvard men, to whom the members of the committee are unable to write personally, will wish to subscribe to this memorial. This circular is therefore sent to all graduates of the college and the scientific school. Those who desire to contribute to the fund are requested to send their subscriptions, large or small (in the form of checks made payable to the Treasurer of Harvard University), to the chairman as soon as possible, in order that a good report of progress, stating the number of subscriptions as well as the total amount subscribed, can be made on commencement day, June 27.

THE ITHACA MEETING.

The meeting of the American Association for the Advancement of Science and the affiliated societies at Cornell University next week is an event of importance in the history of scientific organization and the advancement and diffusion of science in this country. The

association held both a summer and a winter meeting in 1850, but thereafter until 1902 held a single meeting, usually in the month of August. The useful work of the association reached a culminating point some twenty-five years since. At the meetings held in Boston, Montreal and Philadelphia, in 1880, 1882 and 1884, the attendance was between 900 and 1,000. But thereafter there was a decline, until the attendance at Springfield, Buffalo and Detroit, in 1895, 1896 and 1897, was 368, 333 and 268. The Boston meeting of 1898, celebrating the fiftieth anniversary, was large, but on the whole the association was losing ground. This was mainly due to the increased specialization of science and the formation of societies for the different sciences.

The American Society of Naturalists was organized in 1883 to hold winter meetings limited to professional students of science. The special societies subsequently formed for different natural sciences held meetings in affiliation with the Naturalists, and these meetings were nearly as large and had probably more valuable scientific programs than the summer meetings of the association. An American Mathematical Society was also organized, holding its annual meetings at Christmas, and the societies formed later for physics and astronomy tended to affiliate with it. The special societies had a more compact organization than the American Association, due to their professional membership coming mainly from adjacent centers on the Atlantic seaboard. The more amateur and scattering membership of the association was thus emphasized. The association would have suffered severely if it had not been for the affiliation with the American Chemical Society.

If the association were to remain the central organization for the advancement and diffusion of science it was necessary for it to enter into affiliation with the special societies, and if its annual meetings were to be the chief clearing-house for the scientific research and scientific organization of the country it was necessary to hold the principal meeting in winter. If the association had not done these two things one or more new combinations of societies would have arisen, and they would have worked more or less at cross purposes with the association. There have naturally been difficulties to overcome, but on the whole the convocation week meetings have justified themselves. There were nearly a thousand members of the association and probably fifteen hundred scientific men at the Washington and the Philadelphia meetings.

But the transfer of the meetings of the association from summer to winter left one annual meeting where there had previously been two, and this at a time when the membership of the association had more than doubled. The large winter meetings do not so much take the place of the summer meetings as fill an entirely different function. It may almost be said that they substitute business for pleasure.

It is fortunate that the association now finds itself strong enough to supply both. Nothing can be pleasanter than a summer meeting in a university town amid beautiful surroundings, and Ithaca and Cornell supply ideal conditions. In addition to the regular programs of scientific papers addresses of general interest are promised, and excursions certain to be both enjoyable and profitable have been arranged. The new physical laboratories of Cornell University will be formally opened and Sigma Xi will celebrate the twentieth anniversary of its foundation. No more favorable opportunity will occur to see a great university, to visit a region both beautiful and scientifically interesting, to listen to spe-

cial scientific papers and more general addresses, to meet friends and form acquaintances, than the meeting of the American Association and the affiliated societies which begins at Ithaca informally on Thursday evening of next week and formally on the following day.

SCIENTIFIC NOTES AND NEWS.

THE Ordre pour le Mérite has been conferred on Professor Robert Koch by the German Emperor.

THE Society of Arts has awarded its Albert medal to Sir Joseph W. Swan, F.R.S., 'for the important part he took in the invention of the incandescent electric lamp, and for his invention of the carbon process of photographic printing.'

PROFESSOR F. E. NIPHER has been elected a foreign member of the Physical Society of France.

COLUMBIA UNIVERSITY has conferred its doctorate of science on Daniel Giraud Elliot, curator of zoology, Field Museum of Natural History, and on Baron Kanehiro Takaki, surgeon-general (reserve) of the Japanese navy.

SYRACUSE UNIVERSITY has conferred the degree of doctor of laws on Professor Lucien M. Underwood, professor of botany at Columbia University.

ST. LAWRENCE UNIVERSITY has conferred its doctorate of science on Mr. Willis L. Moore, chief of the Weather Bureau.

AT its recent commencement, Union College conferred the honorary degree of doctor of science on C. J. H. Woodbury, of the American Bell Telephone Company, Boston, Mass.; on E. W. Rice, Jr., of the General Electric Company, Schenectady, N. Y., and on Charles S. Prosser, professor of geology in the Ohio State University.

THE Western University of Pennsylvania, at its commencement on June 12, conferred the honorary degree of Sc.D. upon Mr. William T. Hornaday, the director of the New York Zoological Garden at Bronx Park. Owing to recent illness Mr. Hornaday was not able to be present, and the degree was received for him by Dr. W. J. Holland, the director of the Carnegie Museum, who said: "Mr. Hornaday is to-day one of the very foremost men in his calling. He it was who first suggested the establishment of the National Zoological Park in Washington, and from the very beginning until the present hour he has watched over and guided the development of the Zoological Garden in New York until it is to-day the most perfect, the most beautiful and most generously supported institution of its kind upon the globe. His aim has been to popularize knowledge of the animal world. His latest work, 'The American Natural History,' is a splendid book. In honoring Mr. Hornaday the university is honoring herself."

THE Carnegie Institution of Washington, which has subsidized the horticultural work of Mr. Luther Burbank for a term of years, has recently taken additional measures to extend and facilitate the development of this project. Dr. George H. Shull, of the department of experimental evolution, has been sent to Santa Rosa to begin a study of Mr. Burbank's horticultural operations. It is proposed to prepare a volume descriptive of noteworthy products and to examine all available results of breeding experiments with respect to their bearing on questions of hybridization, selection, heredity and variation. The entire investigation is in charge of a committee consisting of President Woodward; Dr. C. B. Davenport, director of the department of experimental evolution; Dr. D. T. MacDougal, director of the department of botanical research, and Dr. A. G. Mayer, director of the department of marine biology. The committee has recently returned from a conference with Mr. Burbank, during the course of which an inspection was made of the breeding grounds and plantations at Santa Rosa and Sebastopol.

PROFESSOR R. S. TARR, of Cornell University, will conduct an expedition to Alaska during the coming summer, with four assistants and a number of packers. This expedition will study the Malaspina and Bering

Glaciers and make a reconnoissance survey of the bed-rock geology of the region between Yakutat and Controller Bays.

PROFESSOR H. L. FAIRCHILD, of the University of Rochester, secretary of the Geological Society of America, will spend the summer on the Pacific coast, and will thereafter attend the International Geological Congress at the City of Mexico.

M. PIERRE JANET, professor of experimental psychology in the Collège de France, has been appointed lecturer at Harvard University next year, and will give a course on the symptoms of hysteria.

MR. ELIHU ROOT, secretary of state, has been elected Dodge lecturer at Yale for 1907. He will lecture on the responsibilities of citizenship.

DR. W. H. MANWARING, of Indiana University, will give a series of twenty-four lectures entitled 'An Introduction to Pathological Physiology,' before the students of Rush Medical College, during the summer quarter.

THE American Medical Association will meet next year in Atlantic City either immediately before or after the meeting of the Congress of Physicians and Surgeons at Washington. The chairmen of the sections are: *Obstetrics and Diseases of Women*—Dr. J. Wesley Bovée, of Washington, D. C.; *Hygiene and Sanitary Science*—Dr. Prince A. Morrow, of New York City; *Diseases of Children*—Dr. J. Ross Snyder, of Birmingham, Ala.; *Pathology and Physiology*— Dr. W. L. Bierring, of Iowa City, Ia.; *Laryngology and Otology*—Dr. S. M. Snow, of Philadelphia; *Ophthalmology*—Dr. G. C. Savage, of Nashville, Tenn.; *Pharmacology and Therapeutics*—Dr. H. C. Wood, Jr., of Philadelphia; *Stomatology*—Dr. Schamberg, of Philadelphia.

A COMMITTEE has been formed with the object of establishing a memorial of the late Sir William Wharton, K.C.B., F.R.S., who died at Cape Town in September, after the British Association meeting in South Africa.

DR. MARY PUTNAM JACOBI, a well-known physician and author of works on medicine and hygiene, died on June 10, at the age of sixty-three years. Mrs. Jacobi was the wife of Dr. Abram Jacobi, emeritus professor of the diseases of children in Columbia University.

THE death is announced of Dr. James Blyth, professor of natural philosophy in the Glasgow and West of Scotland Technical College.

THE Royal Geographical Society of Australasia, Queensland, will celebrate the twenty-first anniversary of its foundation in the last week of June.

THE Selborne Society's annual *conversazione* was held in London, on May 25. About 800 guests were present. In the smaller halls there was a collection of exhibits, including natural history specimens shown under microscopes by fellows of the Royal Microscopical Society, members of the Quekett Club, North London Natural History Society and others. Lord Avebury gave the presidential address. The society now numbers over 1,800 members, and several new branches have been formed during the year.

THE new Cecil Duncombe Observatory at Leeds was opened on May 4 by Professor Turner, of Oxford University, who is a native of Leeds.

Nature states that the German Bunsen Society for Applied Physical Chemistry held its annual general meeting in Dresden under the presidency of Professor Nernst on May 20–23. The business of the meeting included some thirty-five papers, in a group of five of which the value and methods of the fixation of nitrogen for industrial and agricultural purposes were discussed, in another group colloidal bodies were considered, whilst other subjects brought forward were such as technical methods for examining explosives, radiation laws, etc.

ON June 11, the bill for the protection of animals, birds and fish in the forest reserves of California was reported to the senate by the committee on forest reservations and the protection of game without amendment. The house resolution to protect birds and their eggs in game and bird preserves was reported

in the senate by the same committee. The bill appropriating $25,000 for the establishment of a fish-culture station for the propagation of shad and other fishes on St. Johns River, Florida, passed the senate. On June 12 the house resolution for the protection and regulation of the fisheries of Alaska passed the senate with amendment.

UNIVERSITY AND EDUCATIONAL NEWS.

At the graduating exercises of the Brooklyn Polytechnic Institute President Atkinson announced that the trustees had subscribed $800,000 toward the $2,000,000 necessary to endow the proposed extension of the institute, affording facilities for more advanced work.

Mr. and Mrs. Jacob Turtellout, of Minneapolis, have offered to give $400,000 to build and endow an academy for the town of Thompson, Conn.

Dr. Henry M. Saunders, of New York, a trustee of Vassar College, has given $75,000 for the erection of a building, yet undesignated, as a memorial to his wife.

The Drapers' Company has offered £5,000 towards the buildings of the department of agriculture in the University of Cambridge, on condition that an equal sum be raised by the end of the year. The Duke of Devonshire, Lord Rothschild, Lord Strathcona and Sir Ernest Cassel have promised £1,000 each. The Goldsmiths' Company have presented £5,000 to the university for the present needs of the library.

The cornerstone of the new chemical laboratory of Colgate University was laid on June 3 in connection with the commencement exercises. At the same time Lathrop Hall was dedicated.

It is reported that the Andover Theological Seminary is likely to be merged with the divinity school of Harvard University. Andover has considerable endowments, but only fourteen students.

At the University of Colorado, the following degrees were conferred on June 6: B.A., 66; B.S., 14; M.D., 17; LL.B., 12; M. A., 9; Ph.D., 3; total, 121.

At Harvard University, D. W. Johnson, S.B. (Mexico), Ph.D. (Columbia), assistant professor of geology at the Massachusetts Institute, has been appointed assistant professor of physiography; F. T. Lewis, A.B., A.M., M.D. (Harvard), has been promoted to an assistant professorship of embryology.

At the Johns Hopkins University, associate professor Duncan S. Johnson has been promoted to a professorship of botany and associate Caswell Graves to be associate professor of zoology.

Dr. Albert Ernest Jenks, recently chief of the Ethnological Survey of the Philippine Islands, has been elected to an assistant professorship in the department of sociology at the University of Minnesota. The courses presented will be largely ethnological.

George A. Hanford, A.B., Ph.D. (Yale), has been advanced to the position of associate professor of chemistry and physiological chemistry and director of the chemical laboratory in the medical department of Syracuse University.

Dr. E. S. Hall, research assistant in chemistry at the University of Chicago, has been appointed assistant professor of chemistry, and George Winchester, of the University of Chicago, has been elected professor of physics at the University of Washington (Seattle) for the ensuing year.

The following instructors have been appointed at the Massachusetts Institute of Technology for the coming year: M. W. Dole, in mechanical engineering; R. Haskell, in theoretical chemistry; A. F. Holmes, in mechanical engineering; G. W. Eastman, in physics; Charles Field, 3d, in organic chemistry; G. F. Loughlin, in geology; C. H. Mathewson, in analytical chemistry. The following have been appointed as assistants: H. S. Bailey, in technical analysis; J. F. Banash, H. P. Hollnagel and C. S. McGinnis, in physics; S. H. Grauten, C. D. Richardson and E. B. Rowe, in electrical engineering; B. W. Kendall, in electrochemistry; J. F. Norton, in organic chemistry; G. F. White and F. H. Willcox, in analytical chemistry.